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Original Article

Environmental factors, sleep duration, and sleep bruxism in Brazilian schoolchildren: a case-control study

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ABSTRACT

Objective: The purpose of our study was to evaluate the association between environmental factors, sleep duration, and sleep bruxism (SB) in schoolchildren.
Methods: A case-control study was performed. Individuals participating in the study were randomly chosen from public and private schools in Belo Horizonte, Brazil. A total of 120 children with bruxism and 240 without bruxism (mean age, 8 years) participated in our study. A questionnaire for parents was used to collect data based on criteria taken from the American Academy of Sleep Medicine. Conditional binary logistic regression statistical tests and χ^2 tests were used for analysis.
Results: The final logistical model found that children with a median sleep time ⩽8 h per night (odds ratio [OR], 2.561 [95% confidence interval {CI}, 1.480–4.433]), who did not enjoy a good night's sleep (OR, 3.253 [95% CI, 1.600–6.615]), who slept with noise in the room (OR, 2.699 [95% CI, 1.645–4.429]), and who had the light on (OR, 2.370 [95% CI, 1.446–3.884]), were more likely to have SB.
Conclusion: Children who sleep for less than 8 h a night are more likely to have SB. Light and noise in the room were two predisposing factors for the occurrence of SB.

1. Introduction

Sleep bruxism (SB) is defined as a stereotypic movement disorder characterized by the grinding or clenching of teeth during sleep and it usually is associated with arousal in sleep. SB was recently classified as a sleep-related movement disorder according to a review of the classification of sleep disorders [1]. SB is a sleep disorder with multifactorial etiology described as an unusual orofacial parafunctional activity [2–5]. The sleep–wake cycle changes throughout life. From the age of 5 years nocturnal sleep should be fully consolidated, without nocturnal awakenings or the need for daytime naps [6]. Sleep disturbances are among the most common medical concerns during the childhood period [7,8], in which several schoolchildren report sleep problems [9,10].

Some evidence suggests that psychologic factors may play a role in SB [5,11–13], and the presence of SB in children seems to be related to the use of some medications, restless sleep, anxiety, allergies, and headaches [14]. The most common signs and symptoms are tooth wear, disorder of the dental arch support structures, pulpal hypersensitivity, tooth mobility, fractured cusps and restorations, pain, temporomandibular disorder, hypertrophy of the masseter muscle, and headaches [13–16]. Several studies have linked sleep problems with behavioral problems [17,18] and school performance [19], and medical professionals working with children should undertake a detailed anamnesis of sleep habits. The aim of our study was to evaluate the effect of environmental factors and sleep duration on the occurrence of SB in children.

2. Methods

2.1. Study design and sample

Our study is a case-control study nested in a population-based cross-sectional study performed in the city of Belo Horizonte, Brazil, with 652 schoolchildren between the ages of 7–10 years. The city is the capital of the state of Minas Gerais and has considerable economic, social, and cultural disparities. It has 2,375,151 inhabitants, including 341,710 children in the elementary school system (www.censo2010.ibge.gov.br) and is geographically divided into nine administrative districts.

2.2. Sample size calculation

A 95% confidence interval (CI), a 5% margin error, and a 35% prevalence of SB [13] were used to calculate the sample size. A 1

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to 2 matched-pairs case-control study of 8-year-old schoolchildren was performed in the city of Belo Horizonte. A total of 120 children with SB reported by parents and 240 children without SB were included in the study. The children were paired for age, gender, and social vulnerability. The children were selected from six public and three private schools. Subjects were selected from the elementary schools by a process of randomization. The school units comprised one randomly selected public and private elementary school in each administrative district in Belo Horizonte. Written consent and ethical approval were obtained.

2.3. Inclusion criteria

Children who were included in the study had parental authorization, had the responsibility to complete questionnaires, had no other medical or mental disorders (e.g., sleep-related epilepsy, accounts of abnormal movements during sleep) [1], and had no other sleep disorders (e.g., obstructive sleep apnea syndrome).

2.4. Parent questionnaire

Information regarding the presence or absence of SB was provided by parents. The questionnaire was developed based on the criteria of the American Academy of Sleep Medicine. The internal consistency of the instrument was measured using Cronbach α coefficient and ranged from .75 to .96, which shows a strong reliability. This instrument was previously used in other studies [13,14]. Data were collected using parent-completed questionnaires [13]. The questionnaire included a total of 10 questions, eliciting information on the child's history of audible nocturnal teeth grinding, sleep environment (e.g., with lights turned on or with noise), sleep duration, medical history, and sociodemographic data. To ensure the relevance of the family sleeping arrangements to the reporting of bruxism, the survey asked for the following information: the number of times a parent checked on a child during the night, the proximity of parents' and children's bedrooms, and the instance of doors of the parents' and children's rooms remaining open or closed. Over a 3-day period, all parents were instructed to observe and record indicators of the presence or absence of SB among their children in the questionnaire. The children's school delivered the questionnaire together with a reminder to the parents that it should be completed within 3 days.

2.5. Sleep duration

The median number of hours that children slept, or sleep time, during the 3-day period was estimated. The median sleep time per night was 8 h and the sample was dichotomized into equal, less than 8 h, or more than 8 h. A systematic meta-analysis review showed that there was considerable discrepancy in the literature regarding children's sleep duration, being that the ideal time of sleep for children ranged from 5 to 10 h per night [20]. We used a cutoff point of 8 h median sleep duration to transform this continuous variable into a dichotomous variable.

2.6. Environmental factors

Light stimuli included lights turned on in the room where the children slept and situations in which children slept with the door open and the light in the corridor provided indirect light into the children's room. Sound stimuli in the children's room included traffic noise; noise from bars and restaurants near the window; and television, radio, or computers turned on in the room during sleep.

2.7. Diagnosis of SB

Diagnosis followed the classification criteria proposed by the American Academy of Sleep Medicine [1]. These criteria included: parents indicating an occurrence of audible nocturnal teeth grinding in which there were no drugs, no other medical or mental disorders (e.g., sleep-related epilepsy, accounts of abnormal movements during sleep); and absence of other sleep disorders (e.g., obstructive sleep apnea syndrome) [1].

2.8. Social classification

The Social Vulnerability Index (SVI), developed by the Belo Horizonte city council, was used to analyze the exposure of the family to social influence factors [13]. The index measures social exclusion and was developed based on the cultural, social, and demographic context of the local population. It measures the vulnerability of a population through the classification of neighborhood infrastructure, work access, income, sanitation services, healthcare services, education status, legal assistance, and public transportation [21]. Area-based measures of deprivation present a number of advantages, accounting for their increasing importance in healthcare planning and policies. Socially homogenous neighborhoods do not commonly differ in social welfare, attitudes, and behavior [21]. Therefore, the SVI encompasses over 20 variables that quantify the population's access to housing, schooling, income, jobs, legal assistance, health, and nutrition. Likewise, the SVI measures social access and determines to what extent a population is vulnerable to social exclusion. Our study used the city council database of SVI scores for each region based on the address of each participant. This variable was important for matching groups with and without SB.

2.9. Statistical analysis

Results were entered into a database and organized using SPSS for Windows (version 17.0, SPSS Inc., Chicago, IL, USA). Normality of the variable distribution was assessed using the Kolmogorov–Smirnov test, which showed that the assumption of normal distribution could not be confirmed. The χ^2 test with a 95% CI was used to test associations between bruxism, environmental factors, and sleep time. To estimate the probability of the occurrence of bruxism, data were analyzed using binary conditional logistic regression. All variables with P values of less than or equal to .05 were included in the final logistic model.

3. Results

Of the 360 children who participated in the study, 120 had SB and 240 did not. The children also were paired for age, gender, and social vulnerability. The sleep duration reported by parents ranged from 5 to 11 h with a median of 8 h per night, showing that we did not have severe sleep-deprived children in our sample.

Parents reported that 79.1% of children with less than or equal to 8 h of sleep time per night were in the group with SB ($P < .001$) (Table 1). In the case group, 73.3% of children with SB did not have a good night's sleep ($P < .001$) (Table 1). More than half of the children with SB slept with the light turned on (52.5%) and their parents reported noise in the room where the children slept (53.4%) ($P < .001$). Children without SB who slept in environments with no noise or with no light in the bedroom corresponded to 70.8% and 72.1% of the sample, respectively ($P < .001$) (Table 1).

The final logistical model demonstrated that children who had a median sleep time per night equal to or less than 8 h (odds ratio [OR], 2.561 [95% CI, 1.480–4.433]), who did not have an adequate

Table 1
Description of the association analysis between sleep bruxism and the exogenous variables among Brazilian schoolchildren.

Variables	Bruxism		*P* value
	Present (%)	Absent (%)	
Sleep hours			
⩽8 h	95 (79.1)	101 (42.1)	<.001
>8 h	25 (20.9)	139 (57.9)	
Does the child sleep well?			
No	88 (73.3)	16 (6.6)	<.001
Yes	32 (26.7)	224 (93.4)	
Times mother has checked on child in room			
0–1	56 (46.6)	108 (45.0)	.490
⩾2	64 (53.4)	132 (55.0)	
Proximity of parent/children rooms			
Near rooms	117 (97.5)	233 (97.1)	.730
Fast rooms	03 (2.5)	07 (2.9)	
Sleep with light on			
No	57 (47.5)	173 (72.1)	<.001
Yes	63 (52.5)	67 (27.9)	
Noise in room			
No	56 (46.6)	170 (70.8)	<.001
Yes	64 (53.4)	70 (29.2)	

$P < .05$ set as the χ^2 confidence interval.
Values in parentheses refer to the percentages between columns.

Table 2
Conditional binary logistic regression model of variables related to sleep bruxism among schoolchildren and environmental factors.

Variable	OR nonadjusted (95% CI)	*P* value	OR adjusted (95% CI)	*P* value
Sleep hours				
>8 h	1	<.001	1	.001
⩽8 h	2.761 (1.659–4.597)		2.561 (1.480–4.433)	
Does the child sleep well?				
Yes	1	<.001	1	.001
No	4.614 (2.389–8.911)		3.253 (1.600–6.615)	
Noise in room				
No	1	<.001	1	<.001
Yes	2.539 (1.584–4.070)		2.699 (1.645–4.429)	
Sleep with light on				
No	1	<.001	1	.001
Yes	2.809 (1.778–4.436)		2.370 (1.446–3.884)	

Abbreviations: OR, odds ratio; CI, confidence interval.

night's sleep (OR, 3.253 [95% CI, 1.600–6.615]), who slept with noise in the room (OR, 2.699 [95% CI, 1.645–4.429]), and who had the light turned on (OR, 2.370 [95% CI, 1.446–3.884]) were more likely to have SB (Table 2).

4. Discussion

SB is a sleep-related movement disorder. The teeth grinding during sleep is easily identified by the family due to the noise produced [13,14,16,22,23].

The quality of sleep affects health when factors that disturb an individual during sleep can affect his or her day-to-day life [9,23]. Our study found that the majority of children with SB did not sleep well when noise was one of the most important factors influencing sleep quality [8,23]. Sleep is a complex physiologic process influenced by intrinsic biologic properties, temperament, expectations, cultural norms, and environmental conditions [3,24,25]. In our study, environmental factors such as a light turned on or noise in the room were factors associated with SB [25–27]. Sleep duration varies with age; babies need 14–16 h of sleep per day, whereas schoolchildren need 10 h of sleep for restful sleep. Therefore, it is important to encourage restful sleep in children (www.euro.who.int/data/assets).

It was observed that the median sleep time reported by parents in our study was 8 h per night, and children with SB were more likely to sleep less than 8 h per night [24]. The association between sleep deprivation and school performance has been previously studied [19]. A lack of sleep time per night can result in fatigue and a lack of concentration the next day, which can reflect in the educational performance of children [19,26,27]. However, a causal effect association between SB and school performance is yet to be demonstrated. Our analysis deserves evaluation in future studies. SB episodes were found during the ascending phase of the nonrapid eye movement segment of the sleep cycle [28]. The sleep cycle can be influenced by environmental stimuli, and these factors can upset the internal biologic clock affecting sleep duration and sleep disruption [28–30]. Because the human body is controlled by circadian rhythm [29], the light–dark cycle is important to health [29,30]. Light stimuli and background noise can affect the human internal clock and the sleep pathophysiology [28–30]. Our study showed the importance of sleep quality to children's health; therefore, families should be counseled to avoid light and noise in children's bedrooms.

The absence of quality of sleep information obtained directly from the children may be considered a limitation of our study as the information was collected from parents, similar to the methodology of other studies [4,13,14,16,23]. Information directly from the children in relation to how they would describe their sleep experiences and quality of sleep would improve the study. Furthermore, because the study was an epidemiologic survey, the use of more precise sleep measurement tools such as polysomnography was not viable [3]. Despite this limitation, the data provided in our study allow important observations to be made, which justify further exploration of the subject in future longitudinal studies.

Although the reduced sleep quality in children with SB was related to the presence of disturbing noises and light, these are not the only factors that can influence sleep quality. The type of mattress, sleeping position, snoring presence, and nocturnal eating are other aspects that can affect sleep quality and these variables deserve further study.

Medical and dentistry professionals should be encouraged to perform a detailed anamnesis with specific questions relating to sleep duration, quality of sleep, and sleep environment, which can then be easily recorded on a clinical form. With the collaboration of these professionals, families can receive guidance and encouragement to provide improved quality of sleep for their children, and hence promote more adequate health of their children.

5. Conclusion

Based on the results of our study we conclude that: (1) there was an association between the presence of SB and the number of hours of sleep per night, (2) children who slept for less than 8 h per night were more likely to have SB, and (3) light and sound stimuli in the room where children slept were environmental factors associated with SB among children.

Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: http://dx.doi.org/10.1016/j.sleep.2013.08.797.

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References

[1] Grigg-Damberger MM. The AASM scoring manual four years later. J Clin Sleep Med 2012;15:323–32.
[2] Castelo PM, Gavião MBD, Pereira LJ, et al. Relationship between oral parafunctional/nutritive sucking habits and temporomandibular joint dysfunction in primary dentition. Int J Paediatr Dent 2005;15:29–36.
[3] Lavigne GJ, Khoury S, Abe S, et al. Bruxism physiology and pathology: an overview for clinicians. J Oral Rehabil 2008;35:476–94.
[4] Quintero Y, Restrepo CC, Tamayo V, et al. Effect of awareness through movement on the head posture of bruxism children. J Oral Rehabil 2009;36:18–25.
[5] Serra-Negra JM, Paiva SM, Seabra AP, et al. Prevalence of sleep bruxism in a group of Brazilian schoolchildren. Eur Arch Paediatr Dent 2010;11:192–5.
[6] Silva TA, Carvalho LB, Silva L, et al. Sleep habits and starting time to school in Brazilian children. Arq Neuropsiquiatr 2005;63:402–6.
[7] Klein JM, Gonçalves A. Sleep awake problems in children: a study about prevalence. Psico-USF 2008;13:51–8.
[8] Boto LR, Crispim JN, de Melo IS, et al. Sleep deprivation and accidental fall risk in children. Sleep Med 2012;13:88–95.
[9] Lam MH, Zhang J, Li AM, et al. A community study of sleep bruxism in Hong Kong children: association with comorbid sleep disorders and neurobehavioral consequences. Sleep Med 2011;12:641–5.
[10] Rona KJ, Li L, Gulliford MC, et al. Disturbed sleep: effects of socio-cultural factors and illness. Arch Dis Child 1998;78:28–51.
[11] Antonio AG, Pierro VS, Maia LC. Bruxism in children: a warning sign for psychological problems. J Can Dent Assoc 2006;72:155–60.
[12] Restrepo CC, Vásquez LM, Alvarez M, et al. Personality traits and temporomandibular disorders in a group of children with bruxing behaviour. J Oral Rehabil 2008;35:585–93.
[13] Serra-Negra JM, Ramos-Jorge ML, Flores-Mendoza CE, et al. Influence of psychosocial factors on the development of sleep bruxism among children. Int J Paediatr Dent 2009;19:309–17 [published online ahead of print March 23, 2009].
[14] Serra-Negra JM, Paiva SM, Flores-Mendoza CE, et al. Association among stress, personality traits, and sleep bruxism in children. Pediatr Dent 2012;34:e30–4.
[15] Carra MC, Huynh N, Morton P, et al. Prevalence and risk factors of sleep bruxism and wake-time tooth clenching in a 7- to 17-yr-old population. Eur J Oral Sci 2011;119:386–94.
[16] Serra-Negra JM, Paiva SM, Auad SM, et al. Signs, symptoms, parafunctions and associated factors of parent-reported sleep bruxism in children: a case-control study. Braz Dent J 2012;23:746–52.
[17] Smedje H, Broman JE, Hetta J. Associations between disturbed sleep and behavioural difficulties in 635 children aged six to eight years: a study based on parents' perceptions. Eur Child Adolesc Psychiatry 2001;10:1–9.
[18] Paavonen EJ, Räikkönen K, Pesonen AK, et al. Sleep quality and cognitive performance in 8-year-old children. Sleep Med 2010;11:386–92.
[19] Wolfson A, Carskadon MA. Understanding adolescents' sleep patterns and school performance, a critical appraisal. Sleep Med 2003;7:491–506.
[20] Cappuccio FP, Taggart FM, Kandala NB, et al. Meta-analysis of short sleep duration and obesity in children and adults. Sleep 2008;31:619–26.
[21] Braga Lde S, Macinko J, Proietti FA, et al. Intra-urban differences in vulnerability among population [in Portuguese]. Cad Saúde Pública 2010;26:2307–15.
[22] Valera FC, Travitzki LV, Mattar SE, et al. Muscular functional and orthodontic changes in pré school children with enlarged adenoids and tonsils. Ins J Paediatr Otorhinolaryngol 2003;67:761–70.
[23] Cheifetz AT, Osganian SK, Allred EN, et al. Prevalence of bruxism and associated correlates in children as reported by parents. J Dent Child 2005;72:67–73.
[24] Jernelöv S, Lekander M, Almqvist C, et al. Development of atopic disease and disturbed sleep in childhood and adolescence—a longitudinal population-based study. Clin Exp Allergy 2013;43:552–9.
[25] Alves RS, Ejzenberg B, Okay Y. Sleepiness, insomnia and movement sleep disorders in children: a review. Pediatria 2002;24:50–64.
[26] Altun I, Cınar N, Dede C. The contributing factors to poor sleep experiences in according to the university students: a cross-sectional study. J Res Med Sci 2012;17:557–61.
[27] Mendes LR, Fernandes A, Garcia FT. Sleep habits and sleep problems in school aged children. Acta Pediatr Port 2004;35:341–7.
[28] Huynh N, Kato T, Rompré PH, et al. Sleep bruxism is associated to micro-arousals and an increase in cardiac sympathetic activity. J Sleep Res 2006;15:339–46.
[29] Auger RR, Burgess HJ, Dierkhising RA, et al. Light exposure among adolescents with delayed sleep phase disorder: a prospective cohort study. Chronobiol Int 2011;28:911–20.
[30] Campos LA, Plehm R, Cipolla-Neto J, et al. Altered circadian rhythm reentrainment to light phase shifts in rats with low levels of brain angiotensinogen. Am J Physiol Regul Integr Comp Physiol 2006;290:R1122–7.